

## **REMARKS**

Prior to this Amendment, Claims 1-12 were pending and under consideration. With this Amendment, no claims are being currently added, amended or canceled. Thus, after entry of this Amendment, Claims 1-12 remain pending and under consideration. The various rejections of the claims are addressed in detail, below.

### **Rejections under 35 U.S.C. § 102(e)**

Claims 1, 7, and 10-12 are rejected under 35 U.S.C. § 102(e) as being allegedly anticipated by U.S. Patent Application Publication No. 2002/0089023 (Yu *et al.*). Applicant respectfully traverses the rejection.

As the Examiner knows, a claim is anticipated under 35 U.S.C. § 102 only if each and every element as set forth in the claim is found, either expressly or inherently described in a single prior art reference. Applicant respectfully submits that Yu *et al.* do not teach each and every element recited in instant Claim 1, 7 and 10-12.

As an initial matter, Applicant notes that the filing date of Yu *et al.* is January 5, 2001. While Applicant comments on Yu *et al.* on their merit to expedite prosecution of the prosecution of the application, Applicant reserves the right to antedate Yu *et al.* under 37 CFR § 1.131.

As recited in instant Claim 1, the multilayer dielectric film of the present invention comprises a first layer formed of a metal oxide material having a dielectric constant  $\kappa$  and thickness  $t$ ; and a second layer formed on said first layer, said second layer is formed of a metal silicate material having a dielectric constant lower than the dielectric constant of said first layer and a thickness smaller than the thickness of said first layer.

The Examiner argues that Yu *et al.* disclose a multilayer dielectric film comprising a first layer 306 formed of a metal oxide material, referring to paragraph 0041 and Fig. 3. There, however, Yu *et al.* teach a layer of  $M_nO_{m-x}N_x$ , a metal oxide-nitride formed by epitaxially growing. Yu *et al.* do not teach or suggest a first layer of metal oxide material.

Regarding Claim 12, the Examiner argues that Yu *et al.* disclose a multilayer dielectric film comprising a first layer 306 formed of a metal oxide material, again referring to paragraph 0041. Applicant submits that the Examiner's reading of paragraph 0041 of Yu *et al.* is in error.

In paragraph 0041, Yu et al. teach a layer of metal oxide-nitride. Yu et al. do not teach or suggest a first layer of metal oxide material in paragraph 0041 or anywhere in the disclosure.

Accordingly, Applicant respectfully requests reconsideration of the rejections under 35 U.S.C. 102(e) over Yu et al.

Claims 7 and 10-11 recite further limitations of independent Claim 1. They are therefore allowable for at least the same reasons as for Claim 1.

#### **Claim Rejections under 35 U.S.C. § 103(a)**

Claims 1-5 and 7-12 are rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over U.S. Patent Application Publication No. 2001/0013629 (“Bai”). Applicant respectfully traverses the rejection.

As the Examiner knows, to establish a proper *prima facie* case of obviousness, three criteria must be met. First, there must be some suggestion or motivation, either in the cited references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify or combine the cited reference relied upon by the Examiner to arrive at the claimed invention. Second, there must be a reasonable expectation that the suggested modification or combination would be successful. Finally, the prior art reference (or references when combined) must teach or suggest each and every limitation of the rejected claims. The teaching or suggestion to make the claimed modification or combination and the reasonable expectation of success must both be found in the prior art, and not based upon in the applicant’s disclosure. M.P.E.P. §706.02. Applicants respectfully submit that a *prima facie* obviousness has not been established and the invention recited in the instant claims are patentable over Bai in view of Yu et al.

The Examiner argues that Bai discloses a multilayer dielectric film comprising a first layer 120 formed of a metal oxide material, referring to paragraph 0019, a second layer 130 formed of a metal oxide material, referring to paragraph 0018. While the Examiner acknowledges that Bai does not disclose a second layer formed of a metal silicate, the Examiner argues however that Yu et al. disclose a second layer 305 formed of a metal silicate material, referring to paragraph 0039. Accordingly, the Examiner concludes that it would have been

obvious to form the second layer 305 with either metal oxide or metal silicate material.  
Applicant respectfully disagrees.

The courts have long held emphatically that before the Patent Office combines the disclosures of two or more prior art references in order to establish a *prima facie* obviousness, there must be some suggestion for doing so, found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. In *re* Fine, 837 F.2d 1071, 1074 (Fed. Cir. 1988); In *re* Jones, 958 F.2d 347, 351 (Fed. Cir. 1992). The Examiner does not provide any evidence that shows that there is an explicit or implicit teaching or suggestion in any of the cited references to combine Bai with Yu *et al.* to arrive at the claimed invention.

Bai discloses a multilayer gate dielectric including a bottom dielectric material and a top dielectric material. In Bai, the bottom layer serves as a defect-free interface with the substrate. See paragraph 0015, lines 5-8. According to Bai, a defect-free interface is one that has a sufficiently high dielectric breakdown strength implying that the dielectric layer is pin-hole free and contains a negligible number of defects that would lead to breakdown of the dielectric layer at lower electric fields. The bottom dielectric layer should also be stable on silicon and stable against oxide formation. In one embodiment, the bottom dielectric layer materials are chosen that have a heat of formation greater than the heat of formation of SiO<sub>2</sub>. For the defect-free interface function, Bai chose metal oxides as bottom dielectric layer. See paragraph 0018. There is no teaching or suggestion anywhere in Bai that the bottom dielectric layer functions to successfully grow the top dielectric layer.

Yu *et al.* teach a high k oxide-nitride dielectric having a crystalline structure with a lattice constant very close to the lattice constant of substrate materials. In one embodiment in paragraph 0039 as pointed by the Examiner, a template layer 305 suitable to successfully grow layer 306 (top layer) is formed overlying substrate. Thus, the template layer 305 in Yu *et al.* is formed to assist growth of the top dielectric layer and therefore, must be chosen according to the material forming the top layer. For example, Yu *et al.* specify that if layer 306 (top layer) is SrTiO<sub>3-x</sub>N<sub>x</sub> where  $x < 1.5$ , a suitable template layer 305 (bottom) may comprise Si-O-Sr or Si-O-N-Sr. There is no teaching or suggestion anywhere in Yu *et al.* that the template layer can be used as an interface layer as in Bai.

Therefore, neither Bai nor Yu *et al.* provide any teaching that would motivate one of ordinary skill to combine Bai and Yu *et al.* In particular, there is no teaching in Yu *et al.* that the template layer 305 comprising of Si-O-Sr or Si-O-N-Sr is suitable for an interface useful as the bottom layer of Bai.

The Examiner argues that Yu *et al.* teach a multilayer dielectric film comprising a first layer formed of a metal oxide and a second layer formed of a metal silicate material. Accordingly, the Examiner concludes that it would have been obvious to form the second layer with either metal oxide or metal silicate material because as taught by Yu *et al.*, such materials would perform equivalence in functions as a template layer which is used to successfully grow the first layer of metal oxide.

First of all, as stated above, Yu *et al.* do not teach or suggest a first layer formed of a metal oxide. Yu *et al.* teach only a first layer formed of metal oxide-nitride. Second, the assumption made by the Examiner of equivalence in functions of metal oxide and metal silicate as a second template layer applies only to the situation where the first layer is a metal oxide-nitride as in Yu *et al.* The Examiner has not established that the assumption of equivalence in functions of metal oxide and metal silicate is equally applicable to a multilayer film where the first layer is a metal oxide.

In Ex Parte Clapp, 227 USPQ 972 (Bd. Pat. App. & Inter. 1985), the Board of Appeal held that to support the conclusion that the claimed combination is directed to obvious subject matter, the Examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references. The Examiner does not present a convincing line of reasoning as to why one of ordinary skill would have selectively picked or chosen a template layer suitable for growing a top oxide-nitride dielectric layer as taught in Yu *et al.* to combine with Bai to arrive at the dielectric layer of the present invention. Even assuming that the cited references independently teach the metal oxide and metal silicate layers, one of ordinary skill would not have found it obvious to selectively pick and choose Yu *et al.* and Bai to arrive at the multilayer dielectric film of the present invention without using the claims as a guide. Indeed, one of ordinary skill has to be guided by the claims of present invention with respect to the materials, and the thickness, and the dielectric constant.

Claims 2-11 depend on Claim 1 and recite further limitations. They are therefore allowable for at least the same reasons as for Claim 1.

Applicant has reviewed *Ma et al.* and submits that *Ma et al.* do not compensate the deficiencies of *Yu et al.* and *Bai*. *Ma et al.* teach a multilayer dielectric stack having alternating layers of a high  $k$  material and an interposing material. *Ma et al.* do not teach or suggest a multilayer comprising a first layer formed of a metal oxide material having a dielectric constant  $\kappa$  and thickness  $t$ ; and a second layer formed on said first layer, said second layer is formed of a metal silicate material having a dielectric constant lower than the dielectric constant of said first layer and a thickness smaller than the thickness of said first layer.

In view of the foregoing, it is respectfully submitted that this application is now in condition for allowance. If any matters can be resolved by telephone, the Examiner is invited to call the undersigned attorney at the telephone number listed below. The Commissioner is hereby authorized to charge any other fees determined to be due to Deposit Account 50-2319 (Order No. A-70028-2/MSS (463035-964)).

Respectfully submitted,



Tianjun Hou  
Reg. No. 51,821

Customer No. 32940  
DORSEY & WHITNEY LLP  
Suite 3400, 4 Embarcadero Center  
San Francisco, CA 94111-4187  
Telephone: (650) 494-8700  
Facsimile: (650) 494-8771

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